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Morbidity and Mortality Weekly Report (MMWR)

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Environmental Health in MMWR --- 1961--2010

Supplements

October 7, 2011 / 60(04);86-96

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Introduction

As an epidemiology bulletin, *MMWR* has unique strengths and attributes. These include weekly publication (highlighting timeliness and frequency of reporting), rapid turnaround, a close relation with government practitioners of public health (federal, state, and local), and a clear mission of informing the public health community and the general public about new, reemerging, and ongoing threats to the public's health. With its integral relationship to CDC, *MMWR* also is a means of publishing major internal CDC reports, particularly surveillance reports.

The field of environmental health is particularly heterogeneous and diverse. Environmental threats can be categorized singly as particular toxins, chemicals, or risks (e.g., lead, mercury, dioxin, rats, and poisons), grouped by environmental media (e.g., air pollutants, water pollutants, and hazardous wastes), broadly demarcated by environmental place or setting (e.g., homes, communities, and rural environments), or more broadly by national versus global concerns. Similarly, environmental diseases can be categorized as diseases essentially caused by a specific environmental factor (e.g., heat stroke and carbon monoxide [CO] poisoning); diseases caused, triggered, or exacerbated by environmental risk factors (e.g., asthma); or chronic multifactorial diseases for which environmental risk factors are just one category of multiple risk factors (e.g., heart disease or cancer). Beyond disease, natural and human-made disasters (e.g., chemical, biologic, and nuclear/radiation), including terrorist events, are an essential focus of environmental health.

Given the attributes of *MMWR* and the breadth of environmental health, readers might anticipate that *MMWR* environmental health reports focus heavily on new or reemerging epidemic diseases,

disaster situations, chemicals and toxins causing acute clinical illness, newly identified risk factors and threats for acute illness, and surveillance updates for tracking environmental disease. Indeed, such has been the case, particularly in *MMWR*'s early years; however, in recent years, coverage has broadened. This report provides an overview of *MMWR* as it related to environmental health during 1961--2010; the presentation of results follows the outline of the environmental framework ([Table 1](#)) and highlights the public health problems addressed in *MMWR*.

Methods

MMWR online listings were searched by title for all weekly reports broadly related to environmental health; prior years (1960--1964) were searched manually in the print-edition archives. Environmental concerns such as dietary supplements and other sources of toxic and hazardous exposures were included. Occupational exposures were not included, except in rare instances where both occupational and environmental exposures might be considered part of the same event or exposure.

A total of 826 reports were identified and categorized by their main topic for more detailed review ([Table 1](#)). Often, multiple ways existed to aggregate particular environmental problems, but the category that seemed most applicable was selected arbitrarily to enable discussion of topics in the sections believed to be most reasonable; for example, childhood lead poisoning from traditional home remedies is discussed with other sources of lead poisoning rather than with dietary supplements because those exposures are integral to understanding the distribution of lead poisoning cases. In contrast, eosinophilia-myalgia syndrome (EMS) is discussed under epidemic illnesses rather than under dietary supplements because EMS cases constituted a major national epidemic of a new disease and is best considered in that context.

All reports about a single topic or incident are counted separately. In this report, areas that were prominently featured in *MMWR* during the period are highlighted to provide a sense of how *MMWR* covered environmental health during that period.

Certain problems that intersect with environmental health were not included, either because they are covered elsewhere in this volume or because of size limitations in this report (e.g., refugee health or ultraviolet radiation and skin cancer).

Results

Environmental Disease

Poisoning and Illness from Ticks, Mushrooms, Plants, Snakes, Rats, and Other Factors (62 Reports)

These case reports and clusters were heavily represented in the early years of *MMWR*: 14 reports of tick paralysis, all but two before 1981 (the more recent reports emphasize the potential diagnostic confusion with Guillain-Barré syndrome); 24 reports of mushroom and plant poisoning (heavily focused on mushroom poisoning in the early decades, with isolated reports of poisoning from jimsonweed, moonflower, water hemlock, elderberry, and ostrich fern and plants containing belladonna alkaloids in recent decades); and nine reports related to snake bites, rat-bite fever, lionfish stings, arachnidism, sea urchin harvesting, and moth-related dermatitis. The purpose of these reports was to alert the reader to their occurrence and the potential for serious consequences. Fifteen additional reports were related to urban rat control (14 were quarterly surveillance reports for 1979-

-1982, highlighting the success of the existing CDC urban rat control program at that time).

Childhood Lead Poisoning (110 Reports)

During 1961--2010, the incidence, prevalence, mortality, and clinical severity of childhood lead poisoning dramatically declined. *MMWR* served both as an early reporting mechanism to document declining rates nationally and among groups at high risk and as a rapid-alert mechanism to highlight the various ways that children were exposed to lead ([Table 2](#)).

The first report in 1969 demonstrated high rates of lead poisoning, clinical severity, and fatalities in Newark, New Jersey, from exposure to lead paint (1); recent reports on lead paint have served as a reminder that, although much less common, severe effects and death still occur from lead paint ingestion. Early reports from El Paso, Texas (2), and Kellogg, Idaho (3), alerted the country to the striking exposures to children living near lead smelters; the most recent lead report of exposure in Zamfara, Nigeria (4), demonstrated high lead levels and high fatality rates from crude gold mining and smelting operations overseas. Other sources of lead exposure frequently addressed in *MMWR* included lead in dust taken home by workers exposed occupationally, lead in traditional home medicines administered to children, and lead exposure from incorrectly glazed ceramic ware; 21 types of exposure sources were identified from *MMWR* articles ([Table 2](#)). These reports probably make up one of the most detailed collections of the myriad ways in which children have been exposed to lead throughout the last 5 decades. New sources of lead poisoning continue to appear and are often published in *MMWR*. For example, imported charms and necklaces (and a host of other toys) with extremely high lead levels continue to be sold.

After establishment of the Childhood Lead Poisoning Control Program at CDC in 1973, a series of 32 quarterly surveillance reports during 1974--1982 demonstrated the buildup and success of that screening program. Reports in 1991--1992 spoke to the reestablishment of those screening programs.

A most critical function of *MMWR* has been the early release of national surveillance data from the National Health and Nutrition Examination Surveys (5) in 1982, 1994, 1997, and 2005 (more recent updates are in CDC's National Center for Environmental Health/CDC National Reports on Human Exposure to Environmental Chemicals). These reports have documented the dramatic and continuing decline of blood lead levels among children, from 88% of children in the United States with levels of $\geq 10 \mu\text{g}/\text{dL}$ in 1976 to 0.6% of children in 2010. The national trend data have been widely used by the U.S. Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development, CDC, individual states, and others in the development and evolution of programs to eliminate childhood lead poisoning. Additionally, *MMWR* has alerted readers to the issuance of new CDC screening guidelines, new lead legislation, and key reports from state and local health departments on regional and local lead health problems.

Carbon Monoxide Poisoning (45 Reports)

Frequent *MMWR* reports on carbon monoxide poisoning have focused on surveillance updates ($n = 14$), primarily of U.S. mortality data, but also of emergency department rates and individual state data and on case or cluster reports ($n = 3$) that highlight the diverse ways that CO poisoning occurs. Guidance for prevention has been paramount in all of these reports.

The most recent reports on surveillance data, covering 1999--2004 (6), identified approximately 450

unintentional, nonfire-related poisoning deaths per year and 15,000--20,000 emergency department visits per year. A report in 1982 listed unintentional CO deaths of $\geq 1,500$ per year.

The case/cluster reports can be grouped as follows:

1. Home-related (12 reports), all caused by incorrectly vented or malfunctioning gas-powered furnaces, hot water heaters, space heaters, or refrigerators. Also, incorrectly placed generators used during hurricanes and power outages frequently have been identified as a critical problem (see Natural Disaster section below).
2. Vehicle-related (nine reports), either caused by unvented indoor exhaust or close proximity to outdoor exhaust from vehicles, including automobiles, camper trucks, tractors, houseboats, motorboats, and ski boats. Two instances involved portable cook stoves brought inside enclosed camping tents for warmth at night.
3. Commercial buildings with heavy gas-fueled equipment (10 reports) (e.g., ice resurfacing machines in skating arenas, sporting events involving monster trucks and tractor pulls, and indoor power washers and floor polishers).

New and Reemerging Epidemic Diseases (30 Reports)

Perhaps the most prominent function of *MMWR* is to alert the public health community, as well as the general public, to rapidly evolving and unfolding events surrounding occurrence of epidemic diseases; this is particularly true for new diseases or unusual forms of previously known epidemic diseases ([Table 3](#)).

- **Angiosarcoma of the liver.** This illness manifested as a cluster of four cases of this extremely rare disease among vinyl chloride polymerization workers (7); the initial *MMWR* article in 1974 considered vinyl chloride monomer as the causative agent. Subsequent studies confirmed the causal association and detailed the pathogenesis that includes hepatic fibrosis and portal hypertension as precursor conditions (8); national surveillance identified three other known causes of this disease. Identification of vinyl chloride as a carcinogen after >3 decades of widespread use led to dramatic lowering of acceptable occupational exposures and to greatly increased protection of the general population potentially exposed to vinyl chloride in different ways. The follow-up articles examined geographic clusters of these cases in Connecticut and Wisconsin and congenital malformations in two communities near production facilities; those reports did not link community environmental exposures to these findings. In 1997, as part of the celebration of CDC's 50th anniversary, *MMWR* reprinted the original 1974 report and a new editorial note (9).
- **Toxic oil syndrome.** The initial *MMWR* article, published in 1981, described approximately 1,300 persons in Spain hospitalized for atypical pneumonia of uncertain etiology (10). The second report, also published in 1981, documented that approximately 12,000 persons were hospitalized and included results of a case-control study that determined the epidemic's causative vehicle, illicit cooking oil sold by itinerant peddlers in unmarked bottles (11). The final article, which was published in 1982, one year after the start of the epidemic, characterized the decrease in new cases after protective actions and described the evolution of the disease into a chronic phase with pronounced neuromuscular and other findings (12). Although approximately 25,000 persons experienced this new disease, the specific etiologic agent was never identified (13,14).
- **Eosinophilia-myalgia syndrome.** The initial *MMWR* article, published in 1989, described three index patients in New Mexico with eosinophilia-myalgia syndrome (EMS) who had used L-tryptophan dietary supplements, and a preliminary report of additional cases in the state also was linked to ingestion of L-tryptophan (15). By the following week, *MMWR* was able to report results from four states that included two case-control studies linking illness with specific lots of

L-tryptophan ([16](#)). Subsequent reports provided updates from national surveillance, added to knowledge about the clinical spectrum, and provided interim findings on potential contaminants in the L-tryptophan ([17](#)). With nine updates in <1 year, *MMWR* provided timely reporting of this rapidly developing epidemic. From the first report, *MMWR* also noted the clinical similarity of EMS to toxic oil syndrome.

Asthma (26 Reports)

All *MMWR* articles related to asthma appeared after 1989, and the majority related to asthma surveillance. *MMWR* articles have covered such topics as asthma deaths and hospitalization among adults and children and self-reported illness through the Behavioral Risk Factor Surveillance System ([18](#)). Selected reports have evaluated health-care use (e.g., use of inhaled medication and state and local programs). Asthma triggered by specific chemicals and events are covered elsewhere in this report.

Environmental Tobacco/Secondhand Smoke (21 Reports)

Almost all *MMWR* articles on environmental or secondhand tobacco smoke have appeared since 2000. Articles have covered such topics as biomonitoring data from the National Health and Nutrition Examination Survey, which has tracked cotinine levels among U.S. nonsmokers; levels have declined significantly during the past two decades---from a prevalence of 88% ≥ 0.05 ng/mL in the population aged ≥ 4 years (1988--1991) to 40% in the population aged ≥ 3 years (2007--2008) ([19](#)). Other *MMWR* articles have covered exposure to secondhand smoke as reflected in data from the Behavioral Risk Factor Surveillance System and other surveys.

A particular focus of *MMWR* has been the impact of state and local policies to reduce smoking in indoor worksites and in public places (e.g., the New York State comprehensive ban for such sites); undoubtedly, successful implementation of these policies has been a major reason for declining exposures. A recent *MMWR* report took this one step further by noting reduced hospitalization for myocardial infarction after implementation of a smoke-free ordinance in the city of Pueblo, Colorado.

Environmental Threats and Risks

Specific Chemicals, Toxins, and Risk Factors

Over the years, *MMWR* has published reports on the adverse effects of a wide array of chemicals (metals, organic compounds, and pesticides); dietary supplements; consumer products; drugs, devices, and therapeutics; and substances of abuse ([Table 4](#) and [5](#)). Most appear as single reports and covering them all here is not possible. Certain especially instructive reports from each category are mentioned below.

Pesticides (28 reports)

Almost all the *MMWR* reports focused on acute toxicity from inappropriate, unintended, or extremely high exposures. Reported illnesses and deaths included those from fumigants resulting from offsite drift from agricultural use of chloropicrin soil fumigant, phosphine release in a fumigated railroad boxcar, home fumigation with sulfuryl fluoride, and soil fumigation with methyl bromide. *MMWR* reported a widespread outbreak of food poisoning from aldicarb contamination of melons that occurred in California in 1985 ([20](#)); subsequent reports described poisoning from the illegal use of aldicarb as a rodenticide and from its mistaken use in food preparation. Illnesses and fatalities were

reported from inappropriate use of methyl parathion for insecticide control in a home environment with multiple possible routes of exposure to children; a much earlier report from 1970 described poisoning among teenaged boys harvesting tobacco. Two widespread outbreaks of food contaminated with endrin were reported from Pakistan ([21](#)) and the Middle East.

Metals (24 reports)

The vast majority of *MMWR* reports on metals were related to mercury. The largest number addressed individual instances of elemental mercury exposure in homes, schools, or neighborhoods. Multiple reports detailed exposure investigations with potentially broad implications (e.g., identification of elevated mercury exposure from use of interior latex paint that led to changed regulations for such paints [[22](#)] and mercury poisoning among Hispanics in the Southwest from use of beauty creams produced in Mexico [[23](#)]). Articles on the challenges of addressing long-term exposure to low levels of toxins among vulnerable populations appeared only rarely; one such report contained a joint statement of the American Academy of Pediatrics and the U.S. Public Health Service on exposure to thimerosal in vaccines ([24](#)).

Organic compounds (25 reports)

The largest number of *MMWR* reports on organic compounds related to polychlorinated biphenyl (PCB) and dioxin exposures. The PCB-related reports were primarily about instances of high-level, acute exposures (e.g., from transformer fires and food contamination episodes). The dioxin reports focused on multiple prolonged inquiries into long-term effects of dioxin exposure among Vietnam War veterans, Missouri residents exposed to dioxin in soil, and residents near the release of dioxin by a chemical explosion in Seveso, Italy ([25,26](#)). Reports on dioxin exposures represented the infrequent instances in which *MMWR* published reports on the problem of long-term consequences of chemical exposure.

Substances of abuse (40 reports)

Reports related to substances of abuse frequently have been featured in *MMWR* throughout the past five decades. The reports often have related to specific episodes of apparently increased rates of overdoses and fatalities; reports have documented incidents where such increases were related to contaminants (e.g., cocaine containing the antihelminthic drug levamisole or heroin contaminated with scopolamine or clenbuterol). The most dramatic example was the identification of Parkinsonism after exposure to the street drug 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine, a potent analogue of meperidine ([27](#)). As noted elsewhere in this report, the reports from the Hazardous Substances Emergency Events Surveillance (HSEES) system on the acute public health consequences of methamphetamine laboratories have had a strong public health impact ([28](#)).

Dietary supplements (18 reports)

MMWR reports have appeared on lead poisoning from Asian traditional home remedies (discussed previously under childhood lead poisoning), arsenic poisoning from Hmong traditional remedies, agranulocytosis from a phenylbutazone-containing Chinese herbal remedy, and two reports of toxicity from a traditional Chinese remedy called Jin Bu Huan. The *MMWR* report on ingestion of raw carp gallbladders leading to acute hepatitis and renal failure is one of the most unusual food-related articles in this group.

Consumer products (21 reports)

The MMWR articles about consumer products constitute another remarkable collection of acute toxicity and fatalities related to unintended consequences from use of different types of products (e.g., death from digoxin-containing aphrodisiacs [29]). One recurring theme was toxicity from aerosol boot, shoe, and leather conditioner or sealants, with rapid identification of cases leading to product recalls. Another important theme was outbreaks of acute illness and death in neonatal nurseries during the predisposable diaper period (1960s--1970s): strong phenolic laundry detergents left residues that were absorbed through the skin of vulnerable newborns, leading to severe toxicity (30).

Drugs, devices, and therapeutics (12 reports)

This group comprises dramatic reports of rarely experienced toxicity and death from substances. It includes intentional cyanide poisoning from deliberate tampering with over-the-counter medications (31), severe toxicity and deaths among newborns exposed to benzyl alcohol preservatives in intravenous solutions, and severe barium toxicity from use of an absorbable barium salt for radiologic examinations (32).

Environmental Media

Water (60 reports)

Approximately half of the *MMWR* reports on environmental media related to recreational water--associated illness and its prevention. The strong environmental components in these reports emphasized such concerns as swimming pool and public spa inspections and guidelines (33) and injuries and illness from incorrectly used pool chemical disinfectants and chloramine vapors. Chemical contamination of drinking water was reported 10 times, from chlordane, nitrates/nitrites, sewage, phenol, caustic soda, and ethylene glycol; all of these involved elevated exposures and sometimes illness as well (e.g., methemoglobinemia from nitrite exposure). Other environmental aspects included red tides, *Pfiesteria* spp., fluoridation, outbreaks of disease related to *Clostridium* spp. and other waterborne microbes, and one report on inadequately filtered public drinking water. Only a few articles related to regulatory standards for chemicals in drinking water.

Air (13 reports)

For a brief period after reauthorization of the Clean Air Act in 1990 and the release of *Healthy People 2000* (34), a flurry of *MMWR* articles focused on the national impact of air pollution, particularly on the numbers of persons residing in counties exceeding EPA air standards and on the air pollution problems facing state and local health departments. *MMWR* coverage on this topic slowed after 1995.

Food (46 reports)

Eleven reports on surveillance and FoodNet (available at <http://www.cdc.gov/foodnet/>) focused primarily on trends of outbreaks and illness related to specific microbial sources. An article on safer and healthier foods, published as one of *MMWR*'s series on achievements in public health throughout the 20th century, emphasized the role of environmental advances (e.g., refrigeration and pasteurization). During 1960--1979, a total of 21 reports appeared on food poisoning from metals (copper, cadmium, antimony, zinc, chromium, and calcium), and seven more from nitrites, monosodium glutamate, and fluoride, primarily related to contamination of food from faulty equipment, incorrect preparation technique, or mistaken ingredients. Six more recent reports

described unusual exposures (e.g., ammonia contamination of milk, niacin intoxication from bagels, and nicotine poisoning from ground beef).

Hazardous wastes (14 reports)

During the early 1990s, soon after the creation and establishment of the Agency for Toxic Substances and Disease Registry, *MMWR* published a short series of reports and alerts related to developments at that agency (e.g., a statement on the agency's priority health conditions and research strategies) and a short summary of the report on the public health implications of medical waste.

During the past six years, six reports have summarized findings from the Hazardous Substances Emergency Events Surveillance (HSEES) system (e.g., on hazardous substances released during rail transit in 18 states during a six-year period [35]) and on hazardous chemical incidents in U.S. schools for a six-year period. Certain of these HSEES reports on chemical releases and explosions in methamphetamine laboratories helped policymakers more closely regulate these illicit production facilities ([Table 6](#)).

Environmental Places

Healthy homes, healthy communities, and global environmental health (47 reports)

MMWR articles often include information about homes, communities, and global health, usually in the context of a specific problem (e.g., lead poisoning and asthma; hazardous waste disposal; and earthquakes, drought, and famine). During 1961--2010, five reports were related to homeless persons, usually in association with alcohol and substance abuse as risk factors for death, and five reports focused on elevated radon levels in homes. The built environment was a focus of nine reports, most of which considered how environmental features can promote physical activity among adults and children. Environmental features of infectious diseases figured prominently in 17 reports related to outbreaks on cruise ships (e.g., one report documenting the preventive role of regular ship inspections) and in 11 reports related to Legionnaires disease.

Disasters

Natural disasters (153 reports)

Before 1980, *MMWR* rarely reported on natural disasters; reports have escalated rapidly since then ([Table 6](#)). The increase undoubtedly reflects growing engagement by the public health community generally, and by CDC specifically, in disaster preparedness and response. At CDC, this corresponds to the creation of the National Center for Environmental Health in 1980 and its establishment of emergency response and disaster epidemiology units, as well as to the more recent creation of CDC's Office of Terrorism Preparedness and Emergency Response (now the Office of Public Health Preparedness and Emergency Response). The increase in natural disaster reports in *MMWR* has varied by the type of event: volcano reports essentially focused on Mount St. Helens in 1980; tornado reports peaked during the 1980s and 1990s; heat wave reports have been fairly level for the past three decades; and hurricane-related reports have increased steadily throughout the past five decades. This section highlights the findings in six of the most numerous categories. Most of the reports related to U.S. disasters; however, the drought and famine category was global, and the earthquake category mostly so.

- **Volcanoes.** Mount St. Helens came to life with a major eruption on May 18, 1980 (36); *MMWR* published a sequence of 14 reports to provide public health updates and recommendations. This series was a landmark in *MMWR*'s initiating intense engagement on natural disasters; in addition to the *MMWR* sequence of reports, an *MMWR* report published on July 11, 1980, listed a series of 33 technical information bulletins from the Federal Emergency Management Agency. The health bulletins were all based on 23 Mount St. Helens volcano health reports from CDC that continued through February 1981 and were widely distributed throughout the Pacific Northwest. Both *MMWR* short summaries and the more detailed volcano reports covered a wide array of actual and potential health impacts (e.g., illness and death; respiratory health; safety for cleanup workers and loggers; impact on water systems and other key infrastructure; testing for toxic chemicals in the ash; levels of ash fall and monitoring of volcanic activity; and potential for long-term respiratory effects, including pneumoconiosis [37]).
- **Tornadoes.** The group of nine *MMWR* articles on tornadoes began with a landmark report of a 1979 tornado investigation in Wichita Falls, Texas; 44 persons were killed and 171 were hospitalized for injuries (38). Guidance regarding seeking shelter was reaffirmed; however, existing guidance on how to drive out of harm's way was demonstrated to be futile and led to updated recommendations. Subsequent reports highlighted the vulnerability of mobile homes and the need for shelter areas in mobile home parks, the frequent inadequacy and failure of warning systems and sirens, and guidance for adequate sheltering and protection from injury and death. The last report specifically on tornadoes was published in 1997.
- **Heat waves.** The heat wave of summer 1980 led to descriptive epidemiologic and case-control investigations in St. Louis and Kansas City, Missouri. A total of 784 deaths and severe illnesses were attributed to the heat. In another landmark study that changed longstanding public health practice, the results demonstrated that even short periods in an air-conditioned environment were protective, whereas the then-common practice of distributing fans during heat waves was counterproductive. Because the sweating mechanism is compromised during the early stages of heat illness, delivery of hot air by fans exacerbates the situation (39). Reports of the Chicago heat wave in 1995 and of the heat wave in Europe in 2003 emphasized the vulnerability of older persons, infirm persons, and persons in socioeconomically deprived circumstances (40); multiple reports affirmed the effectiveness of having relief workers mobilize older persons for trips to air-conditioned environments (e.g., shopping malls). Recent reports also have highlighted other vulnerable groups for heat illness (e.g., farm workers and high school athletes).

To provide timely public health guidance before the winter and summer seasons, *MMWR* has published approximately two dozen articles about hyperthermia and hypothermia, usually timed to appear before the winter or summer season begins. These reports have provided summary statistics on heat- and cold-related deaths in the United States, instructive case reports from multiple states highlighting risk factors, and updated public health guidance.

- **Earthquakes.** Reports have focused on assessments of mortality and morbidity (Italy, 1981; Loma Prieta, California, 1989; Philippines, 1990); coccidioidomycosis after the Northridge, California, earthquake in 1994; health-related needs assessments linked to response or surveillance (Turkey, 1999; Indonesia and Thailand tsunami, 2004), victim identification (Thailand tsunami, 2004), and surveillance (Haiti, 2010). These largely have been acute-phase reports related to early assessments of the magnitude of the problem and the extent of acute public health needs.
- **Hurricanes.** Hurricanes have been increasingly the most commonly reported category of natural disaster published in *MMWR*, although approximately half of all such reports (22/46) related to Hurricane Katrina. For the reports not related to Hurricane Katrina or Hurricane Rita, four major themes are apparent:
 - Needs assessment surveys were reported in *MMWR* for Hurricanes Ike, Wilma, a cluster of Florida hurricanes in 2004 (three articles), Allison, Georges, Marilyn and Opal, and Andrew (two articles). Needs assessments usually targeted vulnerable groups (e.g., older persons or rural

populations).

--- CO poisoning from unsafe generator use was reported for Ike and the Florida cluster; also, one report involved dry ice--induced CO poisoning in the 2004 Florida cluster.

--- Medical examiner mortality data were analyzed and reported in *MMWR* for the 2004 Florida cluster, Floyd, Marilyn and Opal, Andrew, and Hugo (two articles).

--- Surveillance data were reported for illness and injury rates at Marilyn and Opal, Hugo, and Elena and Gloria. The only other reports were related to mosquito-control efforts at Andrew and evaluation of postdisaster work-related electrocutions from downed power lines after Hugo.

Katrina was much more complex for multiple reasons, including the devastating destruction and flooding over multiple states, the approximately one million evacuees, the long time frame for restoring basic functions and repopulating New Orleans, and the extended periods spent by thousands of persons in shelters and temporary trailers. For Hurricane Katrina, four reports were published about rapid needs assessment, three on CO poisoning, one on mortality, and seven on surveillance for injury and illness in health-care facilities and evacuation centers. Reports related to the special features of Katrina included information about relief workers and occupational guidance, the ubiquitous mold problem, a norovirus outbreak in a shelter, two cases of toxigenic *Vibrio cholerae* O1, and the substantial number of tuberculosis patients temporarily lost to follow-up during the chaos of the evacuation.

- **Drought and famine.** All seven reports describe investigations of major drought impact in Africa (Niger, 2005; Ethiopia, 2000; Somalia, 1987; Niger 1985; Burkina Faso, 1985; Chad, 1985; and Mauritania, 1983). These reports described collaboration among CDC, the U.S. Agency for International Development, United Nations' agencies (e.g., UNICEF), and country governments. These reports also described surveys that were conducted of children as the most vulnerable group, and relief efforts focused on nutritional status, respiratory and gastrointestinal disease, measles vaccination, and vitamin A and C deficiencies.

Biologic, chemical, radiation, and nuclear (four reports)

During 1961--2010, several additional reports were related to potential adverse effects of chemical warfare agents. With the growth of environmental programs at CDC---the National Center for Environmental Health was created shortly after, and largely as a result of, the 1979 Three Mile Island event---readers might anticipate more complete coverage of such events in the future. Perhaps as a reflection of that, the most recent *MMWR* covered in this report relates to radiologic and nuclear preparedness and summarizes a CDC Grand Rounds session (41); additional reports relate to potential adverse effects of chemical warfare agents.

Terrorism

World Trade Center attack (15 reports)

The sequence of 15 *MMWR* articles after the September 11, 2001, terrorist attacks was the second largest series of reports related to a single environmental event. The initial overview of activities in response to the attacks appeared on September 28, 2001 (42). Six of the reports related to occupational concerns: exposures to workers at and near the site, injury and illness rates among workers, use of respiratory protective equipment, and follow-up of first responders' mental and physical health. The themes of the initial environmental reports were similar to those in other disaster settings: community needs assessment; investigations of deaths; and surveillance for injuries and illness, including a review of syndromic surveillance (43). A pilot survey of airborne and settled dust in residences did not find evidence of substantive asbestos exposure, although dust of pulverized building materials was present (44). Follow-up reports tracked residents' respiratory and mental

health. Subsequent publications have addressed these findings more fully and documented the elevated rates of new-onset asthma and posttraumatic stress disorder; the World Trade Center Registry was instrumental in enabling a thorough evaluation of these concerns (45). The ability to publish approximately a dozen detailed and pertinent follow-up reports about critical aspects of this disaster in less than a year demonstrates the unique value of *MMWR* to meet the need for accurate and timely information after such disasters.

Discussion

This review of 826 *MMWR* articles demonstrates the scope of *MMWR*'s coverage of environmental health and the remarkable diversity and richness of the field. Over five decades, *MMWR* has reported on hazards and diseases both old and new. A reader of these reports is struck by all the ways that old and well-known hazards can resurface under unanticipated circumstances. For example, the *MMWR* reports on lead and CO poisoning and pesticides are full of new exposure pathways that constantly surprise. *MMWR* has been an excellent resource for highlighting and tracking surveillance data for environmental diseases (e.g., lead poisoning, CO poisoning, and asthma) and for reporting biomonitoring results that demonstrate population exposure trends for cotinine, lead, mercury, and other substances.

MMWR has been at its best in highlighting and tracking new outbreaks of disease, unfolding disasters (both natural and human-made), urgent public health scenarios, and the multiple ways in which illness and death can occur from exposures to chemicals and hazards. It is a unique resource for timely updates of major events (e.g., Mount St. Helens; Hurricane Katrina; the 2001 attack on the World Trade Center, and epidemics, including the outbreak of EMS). It is an effective way to provide preliminary reports of complex investigations that highlight important public health messages (e.g., with the 1980 heat wave investigation or the toxic oil syndrome investigation). Additionally, it likely represents the most remarkable collection of reports on outbreaks, illness, and death in existence from pesticides to natural poisons, dietary supplements, home remedies, chemicals, and consumer products.

Over its five decades at CDC, *MMWR* reports on environmental health have focused mostly on acute, high-dose, clinically apparent, and urgent risks. This analysis of *MMWR* reports over 50 years shows this repeatedly --- scores of reports on acute outbreaks related to water pollutants, pesticides, and CO. During the 50 years, *MMWR* has focused much less on chronic, long-term risks from repeated low-level exposures and the policy and regulatory approaches that society employs to protect the public from such risks. This is understandable given that the *MMWR* weekly, with its traditional short, telegraphic form, was created to report on immediate threats to the public health. Authors have generally recognized that, for analyses that require more complex epidemiologic analyses and description, long-form peer-reviewed medical and public health journals are a more conducive forum, although the *MMWR* Surveillance Summaries do publish long-form compendiums of surveillance findings.

In recent years, this has begun to change as authors of longer-term studies have wished to capitalize on *MMWR*'s appeal to the news media and the nation's public health readership. Even with its short format, the *MMWR* weekly now often publishes reports on long-term public health exposures and resultant illnesses, or on health behaviors. In *MMWR*'s next 50 years, as it continues to cover the field of environmental health and as that field increases in importance even beyond its current state,

MMWR might consider periodic (i.e., monthly or quarterly) reports on environmental health policies, risk analysis, regulatory approaches, long-term epidemiologic studies, or other areas that can be meaningfully presented to the broader public health community. This might further enhance the critical value of *MMWR* to the field of environmental health.

Acknowledgments

The contributor thanks Stephen B. Thacker, MD, MSc, for his always thoughtful and perceptive comments; and C. Kay Smith, MEd, for her editorial assistance.

References

1. CDC. Lead poisoning---Newark, New Jersey. *MMWR* 1970;19:358.
2. CDC. Human lead absorption---Texas. *MMWR* 1997;46:871--7.
3. Landrigan PJ, Baker EL. Exposure of children in heavy metals from smelters: epidemiology and toxic consequences. *Environ Res* 1981;25:204--24.
4. CDC. Outbreak of acute lead poisoning among children aged <5 years---Zamfara, Nigeria, 2010. *MMWR* 2010;59:846.
5. CDC. Blood lead levels---United States, 1999--2002. *MMWR* 2005;54:513--6.
6. CDC. Carbon monoxide-related deaths---United States, 1999--2004. *MMWR* 2007;56:1309--12.
7. Falk H, Creech JL Jr, Heath CW Jr, Johnson MN, Key MM. Hepatic disease among workers at a vinyl chloride polymerization plant. *JAMA* 1974;230:59--63.
8. Thomas LB, Popper H, Berk PD, Selikoff I, Falk H. Vinyl chloride induced liver disease. From idiopathic portal hypertension (Banti's syndrome) to angiosarcomas. *N Engl J Med* 1975;292:17--22.
9. CDC. Angiosarcoma of the liver among polyvinyl chloride workers---Kentucky. *MMWR* 1997;46:97--101.
10. CDC. Atypical pneumonia---Spain. *MMWR* 1981;30:237--8.
11. CDC. Follow-up on toxic pneumonia---Spain. *MMWR* 1981;30:436--8.
12. CDC. Follow-up on epidemic pneumonia with progression to neuromuscular illness---Spain. *MMWR* 1989;31:93--5.
13. Rigau-Pérez JG, Pérez-Alvarez L, Dueñas-Castro S, et al. Epidemiologic investigation of an oil-associated pneumonic paralytic eosinophilic syndrome in Spain. *Am J Epidemiol* 1984;119:250--60.
14. Kilbourne EM, Rigau-Pérez JG, Heath CW Jr, et al. Clinical epidemiology of toxic-oil syndrome: manifestations of a new illness. *N Engl J Med* 1983;309:1408--14.
15. CDC. Eosinophilia-myalgia syndrome---New Mexico. *MMWR* 1989;38:765--7.
16. CDC. Eosinophilia-myalgia syndrome and L-tryptophan-containing products---New Mexico, Minnesota, Oregon, and New York, 1989. *MMWR* 1989;38:785--8.
17. Swygert LA, Maes EF, Sewell LE, Miller L, Falk H, Kilbourne EM. Eosinophilia-myalgia syndrome: results of national surveillance. *JAMA* 1990;264:1698--703.
18. CDC. Asthma prevalence and control characteristics by race/ethnicity---United States, 2002. *MMWR* 2004;53:145--8.
19. CDC. Vital signs: nonsmokers' exposure to secondhand smoke---United States, 1999--2008. *MMWR* 2010;59:1141--6.
20. CDC. Aldicarb food poisoning from contaminated melons---California. *MMWR* 1986;35:254--8.
21. CDC. Acute convulsions associated with endrin poisoning---Pakistan. *MMWR* 1984;33:687--8,693.
22. Agocs MM, Etzel RA, Parrish RG, et al. Mercury exposure from interior latex paint. *N Engl J Med* 1990;323:1096--101.

23. CDC. Update: mercury poisoning associated with beauty cream---Arizona, California, New Mexico, and Texas, 1996. MMWR 1996;45:633--5.
24. CDC. Thimerosal in vaccines: a joint statement of the American Academy of Pediatrics and the Public Health Service. MMWR 1999;48:563--5.
25. CDC. Serum 2,3,7,8-tetrachlorodibenzo-*p*-dioxin levels in Air Force health study participants---preliminary report. MMWR 1988;37:309--11.
26. CDC. Health-risk estimates for 2,3,7,8-tetrachlorodibenzodioxin in soil. MMWR 1984;33:25--7.
27. CDC. Street-drug contaminant causing Parkinsonism. MMWR 1984;33:351--2.
28. CDC. Acute public health consequences of methamphetamine laboratories---16 states, January 2000--June 2004. MMWR 2005;54:356--9.
29. CDC. Deaths associated with a purported aphrodisiac---New York City, February 1993--May 1995. MMWR 1995;44:853--5,861.
30. CDC. Pentachlorophenol poisoning in newborn infants---St. Louis, Missouri. MMWR 1967;16:334--5.
31. CDC. Cyanide poisonings associated with over-the-counter medication---Washington state, 1991. MMWR 1991;40:161,167--8.
32. CDC. Barium toxicity after exposure to contaminated contrast solution---Goias state, Brazil, 2003. MMWR 2003;52:1047--8.
33. CDC. Violations identified from routine swimming pool inspections---selected states and counties, United States, 2008. MMWR 2010;59:582--7.
34. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives--full report, with commentary. Washington, DC: US Department of Health and Human Services, Public Health Service, 1991; DHHS publication no. (PHS)91-50212.
35. CDC. Hazardous substances released during rail transit---18 states, 2002--2007. MMWR 2007;56:553--6.
36. Baxter PJ, Ing R, Falk H, et al. Mount St Helens eruptions, May 18 to June 12, 1980: an overview of the acute health impact. JAMA 1981;246:2585--9.
37. Buist AS, Bernstein RS, eds. Health effects of volcanoes: an approach to evaluating the health effects of an environmental hazard. Am J Public Health 1986;76(Suppl):1--90.
38. Glass RI, Craven RB, Bregman DJ, et al. Injuries from the Wichita Falls tornado; implications for prevention. Science 1980;207:734--8.
39. Kilbourne EM, Choi K, Jones TS, Thacker SB. Risk factors for heatstroke: a case-control study. JAMA 1982;247:3332--6.
40. Semenza JC, Rubin CH, Falter KH, et al. Heat-related deaths during the July 1995 heat wave in Chicago. N Engl J Med 1996;335:84--90.
41. CDC. CDC Grand Rounds: radiological and nuclear preparedness. MMWR 2010;59:1178--81.
42. CDC. New York City Department of Health response to terrorist attack, September 11, 2001. MMWR 2001;50:821--2.
43. CDC. Syndromic surveillance for bioterrorism following the attacks on the World Trade Center--New York City, 2001. MMWR 2002;51(special issue):13--5.
44. CDC. Potential exposures to airborne and settled surface dust in residential areas of lower Manhattan following the collapse of the World Trade Center---New York City, November 4--December 11, 2001. MMWR 2003;52:131--6.
45. Farfel M, DiGrande L, Brackbill R, et al. An overview of 9/11 experiences and respiratory and mental health conditions among World Trade Center Health Registry enrollees. J Urban Health 2008;85:880--909.

TABLE 1. Environmental framework/structural outline as applied to this MMWR

review and number of MMWR articles for each topic* --- 1961--2010

Category

Environmental disease

Environmental poisons (62), childhood lead poisoning (110), carbon monoxide poisoning (45)

New and reemerging epidemic diseases (30)

Asthma (26)

Environmental tobacco/secondhand smoke (21)

Environmental threats and risks

Specific chemicals (pesticides [28], metals [24], organic compounds [25]); substances of abuse (40); dietary supplements (18); consumer products (21); drugs/devices/therapeutics (12); other (3)

Media: water (60), air (13), food (46), hazardous wastes (14)

Places: homes, communities, global (47)

Disasters

Natural (volcanoes, tornadoes, heat waves, earthquakes, hurricanes, drought/famine) (153)

Biological/chemical/radiation/nuclear (4)

Terrorism: World Trade Center/other (24)

* Total number of MMWR weekly reports = 826.

TABLE 2. Source of exposure, number of reports, location of investigation, and date of publication for lead poisoning investigations reported in MMWR --- 1961--2010

Source of exposure/risk factor	No. MMWR reports	State/location (no. reports)	October 7, 2011s
Folk remedies (primarily from Mexico and Asia)	10	CA (5); TX (2); CN, CO, FL, MA, MN, NH, NY (1 each)	7/9/2004; 8/9/2002; 1/22/1999; 7/16/1993; 9/8/1989; 11/16/1984; 10/28/1983; 10/28/1983; 11/6/1981; 1/8/1982
Lead paint (fatalities, encephalopathy, and elevated		NJ (3); NY (2);	1/30/2009; 6/8/2001; 1/3/1997;

exposures among children; home renovation and stripping paint)	8	MA, NH, WI (1 each)	3/29/1991; 3/23/1979; 6/9/1978; 12/16/1977; 12/12/1970
Living near mining and smelting operations (El Paso, TX; Kellogg, ID; Zamfara, Nigeria)	7	TX (4), ID (2), Nigeria (1)	7/16/2010; 9/19/1997; 2/24/1978; 1/10/1976; 9/14/1974; 5/4/1974; 12/8/1973
Dust taken home from occupational exposure	7	CO (2); CA, ME, NC, TN, VT (1 each)	8/21/2009; 4/6/2001; 5/19/1989; 6/28/2005; 2/25/1977; 9/30/1977; 3/26/1976
Glazed ceramics	5	NY (2); AR, NJ, OR (1 each)	7/9/2004; 10/23/1992; 6/2/1989; 8/10/1974; 6/5/1971
Drinking water	4	DC (3); AZ, CA (1 each)	6/25/2010; 5/21/2010; 4/2/2004; 10/21/1994
Ingestion of charm/necklace	2	MN, OR (1 each)	3/31/2006; 6/18/2004
Imported candy from Mexico	2	CA (2); MI (1)	8/9/2002 (duplicate); 12/11/1998
Indoor firing range (student shooting team; National Institute for Occupational Safety and Health survey)	2	AK, multiple (1 each)	6/17/2005; 9/23/1983
Gasoline sniffing (tetraethyl lead exposure)	2	AZ, VA (1 each)	7/26/1985; 8/7/1981
Refugee children and adoptees (US)	2	NH, US (1 each)	1/21/2005; 2/11/2000
Chelation therapy-deaths from hypocalcemia	1	OR, PA, TX (1 each)	3/3/2006
Litarigio-antiperspirant/deodorant	1	RI (1)	3/11/2005
Dental offices	1	WI (1)	10/12/2001
Chewing plastic wire coating	1	OH (1)	6/25/1993
Moonshine/illicitly distilled alcohol	1	AL (1)	5/1/1992
Battery repair shop: living nearby	1	Jamaica (1)	7/14/1989
Intravenous amphetamine use	1	OR (1)	12/8/1989

TABLE 3. New and reemerging epidemic diseases broadly related to environmental factors reported in *MMWR* --- 1961--2010

Disease/syndrome	Date of initial report, location	Presentation	Date of follow-up reports
Hepatic angiosarcoma	2/15/1974, KY	Cluster of fatal liver cancer cases in vinyl chloride polymerization workers	6/21/1974; 7/25/1975; 3/5/1976; 2/7/1997
Toxic oil syndrome	5/25/1981, Spain	Atypical pneumonia, eosinophilia, and neuromuscular disease from illicit cooking oil	9/4/1981; 5/5/1982
Eosinophilia-myalgia syndrome	11/17/1989, NM	Eosinophilia, neuromuscular disease from L-tryptophan dietary supplement	11/24/1989; 12/8/1989; 1/12/1990; 2/16/1990; 5/18/1990; 8/31/1990 (×2); 11/2/1990; 8/21/1991
Toxic hypoglycemic syndrome (Jamaican vomiting sickness)	1/31/1992, Jamaica	Profound hypoglycemia, vomiting, convulsions from ingestion of unripe ackee fruit	
Epidemic neuropathy*	3/18/1994, Cuba	Subacute optic and peripheral neuropathy likely from nutritional deficiency/tobacco smoking	
Renal failure†	8/2/1996, Haiti; 12/11/2009, Nigeria	Among children, from ingestion of diethylene glycol--contaminated acetaminophen syrup	
Acute idiopathic pulmonary hemorrhage among infants	12/9/1994, OH	Hypothesized/unproven association with water damage, mold, or fungi	2/3/1995; 1/17/1997; 3/10/2000; 6/15/2001; 9/10/2004
Acute aflatoxicosis§	9/3/2004, Kenya	Jaundice from moldy, contaminated maize	
Gulf War illness	6/16/1995, Veterans	Unexplained illness/syndrome among Persian Gulf War	

veterans

* CDC. Epidemic neuropathy---Cuba, 1991--1994. MMWR 1994;43:189--92.

† CDC. Fatalities associated with ingestion of diethylene glycol-contaminated glycerin used to manufacture acetaminophen syrup---Haiti, November 1995--June 1996. MMWR 1996;45:649--50; and CDC. Fatal poisoning among young children from diethylene glycol-contaminated acetaminophen---Nigeria, 2008--2009. MMWR 2009;58:1345--7.

§ CDC. Outbreak of aflatoxin poisoning---eastern and central provinces, Kenya, January--July 2004. MMWR 2004;53:790--3.

TABLE 4. Adverse effects of pesticides, metals, organics, and other exposures reported in MMWR --- 1961--2011

Pesticides (no. reports)	Metals (no. reports)*	Organic compounds (no. reports)	Other (no. reports)
Methyl parathion (4)			Asbestos soil exposure (1)
Aldicarb (3)	Mercury (21), including elemental mercury, thimerosal, organic mercury, and beauty cream	Dioxin (8); including in Vietnam War veterans; Missouri soil; and Seveso, Italy	Radiation (2)
Endrin (3)		Polychlorinated biphenyls (PCBs) (7)	
Mosquito control spray (3)	Thallium (2)	Polybrominated biphenyls (PBBs) (2)	
Fumigants (3)	Arsenic (1)	Dichlorodiphenyltrichloroethane (DDT) (2)	
Diazinon (2)		Trichloroethylene (TCE) (1)	
Lindane (1)		Gasoline spill (1)	
Rodenticide containing TETS (1)		Biodiesel, home production (1)	
DEET (1)		Toluene diisocyanate (1)	

Sulfuryl fluoride
(1)

Compounds at Love Canal,
Niagara Falls, New York (1)

Chlorpyrifos (1)

1, 3-dichloropropene (1)

Carbophenothion
(Trithion) (1)

Organophosphates,
multiple (4)

*Not including lead poisoning and selected problems highlighted elsewhere in this report.

TABLE 5. Adverse effects of substances of abuse, dietary supplements, consumer products, drugs, devices, or therapeutics reported in MMWR --- 1961--2011

Substances of abuse (no. reports)	Dietary supplements and unorthodox remedies (no. reports)	Consumer products (no. reports)	Drugs, devices, and therapeutics (no. reports)
Heroin (8)	Asian traditional remedies (4), including Chinese (3) and Hmong (1)	Aerosolized carpet shampoo and aerosol conditioner for shoes, boots, and leather products (4)	Nasopharyngeal radium irradiation/head and neck cancer (1)
Marijuana (6)			
Cocaine (5)	Herbal teas (3), including Kombucha, senna cathartics (1), foxglove (1), and pyrrolizidine alkaloids (1)	Hexachlorophene baths and newborn neuropathology (4)	Benzyl alcohol preservatives/neonatal deaths (1)
Methamphetamine (5)			
<i>Gamma</i> -Hydroxybutyric acid (2)			
Isobutyl nitrite (1)	Selenium (1)	Neonatal toxicity from use of phenolic laundry detergents in neonatal nursery (3)	Diidohydroxyquin-induced blindness (1)
Ecstasy (1)	High-dose vitamin A (1)	Neonatal toxicity from use of phenolic laundry detergents in neonatal nursery (3)	Prilocaine-induced methemoglobinemia (1)
Ecstasy (1)	Turpentine/castor oil (1)	Pentachlorophenol exposure in log cabins (2)	Ephedrine and cryoglobulinemia vasculitis disease (1)
General/multiple (12)	Chaparral (1)	Limes and phototoxic dermatitis (1)	
		Butyl caulk and toluene toxicity (1)	Cyanide tampering of Sudafed(r) (1)

<i>Gamma</i> -butyrolactone as source of <i>gamma</i> -hydroxybutyrate (date-rape drug) (1)	Naphthalene toxicity from mothballs (1)	Sporicidin device sterilant (1)
Kava (1)	Indoor paint containing Bis (tributyltin) oxide (1)	Undiluted 25% intravenous human albumin and hemolysis (1)
Herbal supplement with aretemisinin (1)	Chlorine gas generated by mixing bleach with commercial phosphoric acid cleaner (1)	Halofantrine and sudden death (1)
Pennyroyal oil (1)	Household lamp oil ingestion and toxicity (1)	Colchicine overdose from pharmaceutical compounding error (1)
Raw carp gallbladders (1)	Spray adhesive use in pregnancy (1)	
Mesotherapy (1)	Digoxin-containing aphrodisiacs and death (1)	Gadolinium contrast agent and renal disease (1)
Silicone filler injections (1)		Soluble barium sulfate contrast solution and overdose deaths (1)

TABLE 6. Number of MMWR articles related to natural disasters, by decade --- 1961-2010

Category	1961--1970	1971--1980	1981--1990	1991--2000	2001--2010	Total
Hurricanes			5	9	32	46
Heat waves	1	2	6	9	8	26
Extreme cold			4	7	7	18
Volcanoes		12	2			14
Earthquakes		1	3	2	6	12
Tornadoes		1	3	5		9
Winter storms/snow			1	6	1	8

Floods			2	5		7
Drought/famine			5	1	1	7
Lightning				1	1	2
Wildfires					2	2
General			1		1	2
Total	1	16	32	45	59	153

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Page last reviewed: October 07, 2011
 Page last updated: October 07, 2011
 Content source: [Centers for Disease Control and Prevention](#)

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